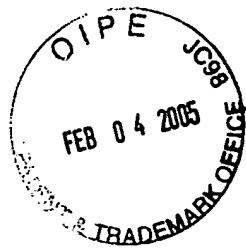


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PATENT APPLICATION

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of:	)	
	:	Examiner: R. Gleitz
KOHEI KOSHIDA	)	
	:	Group Art Unit: 2852
Appln. No.: 10/600,704	)	
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Filed: June 23, 2003	)	
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For: IMAGE FORMING APPARATUS	)	February 4, 2005

Mail Stop Amendment  
Commissioner for Patents  
P.O. Box 1450  
Alexandria, VA 22313-1450

LETTER FORWARDING SUBSTITUTE SPECIFICATION

Sir:

Applicant submits herewith a substitute specification. The substitute specification incorporates changes to the specification and Abstract to correct minor grammatical, idiomatic and spelling informalities. A marked-up copy of the original specification, showing the matter added and deleted in the substitute specification, is also submitted herewith.

Applicant's undersigned attorney has reviewed the substitute specification and submits that the substitute specification contains no new matter.

Applicant believes that no fees should be incurred in connection with filing this paper. However, the Commissioner is authorized to charge Deposit Account No. 06-1205, should any fees be required.

Favorable consideration is requested.

Applicant's undersigned attorney may be reached in our Washington, D.C. office by telephone at (202) 530-1010. All correspondence should continue to be directed to our below-listed address.

Respectfully submitted,



Mark A. Williamson  
Attorney for Applicant  
Registration No. 33,628

FITZPATRICK, CELLA, HARPER & SCINTO  
30 Rockefeller Plaza  
New York, New York 10112-3801  
Facsimile: (212) 218-2200  
MAW\mt

DC\_MAIN 192288v1



## IMAGE FORMING APPARATUS

### Background of the Invention

#### 1. Field of the Invention

[0001]

This invention relates to a layout structure for electrophotographic photocopiers, printers, recording apparatuses, and the like.

#### 2. Description of Related Art

[0002]

Multicolor image forming apparatuses using an electrophotographic method tend to require an increased number of developing units and complicated processes, such as development and transfer in overlapping the respective colors, and fixture of multi-layer toners, in comparison with conventional monochrome engines. Those apparatuses are further subject, with high frequency, to replacement of electrostatic latent image forming bodies, such as color developers and photosensitive bodies, and a jamming recovery operation for the engine is also needed. Therefore, an engine structure excellent in maintenance and jamming recovery property is demanded.

[0003]

Fig. 6 shows a perspective view of a conventional example. A primary charger, a developing unit, and a transfer charger (all not shown) are disposed around each photosensitive drum, and form respective units as process cartridges 1a

to 1d. Numeral 5 denotes a fixing unit; numeral 4 denotes a feeding cassette; numeral 3 denotes a secondary transfer roller; numeral 2 denotes an intermediate transfer belt (intermediate transfer body); and numeral 7 denotes a delivery tray.

[0004]

During maintenance of the process cartridges 1a to 1d, a side door 10 is opened to allow the process cartridges 1a to 1d to be pulled out. As shown in Fig. 7, the intermediate transfer belt 2 is then moved in a direction of arrow X to release pressure between the intermediate transfer belt 2 and the photosensitive drums 20a to 20d of the process cartridges 1a to 1d.

[0005]

The process cartridges 1a to 1d are made to slide in a direction of arrow Y as shown in Fig. 6, and new process cartridges 1a to 1d are inserted. When a transfer material is jammed in a conveyance route 25, a front door 11 is openable in a front and back direction at the conveyance route 25 to allow jamming treatment.

[0006]

In Japanese Patent Application Publication JP-A-11-133,694, to improve jamming recovery and controllability, a mechanism in which the transfer portion is openable forwardly around an apparatus lower portion as a center, and a mechanism in which the photosensitive body belt portion is lifted upward around an apparatus rear portion as a center are provided, thereby allowing maintenance work and paper jamming recovery.

[0007]

With the multicolor image forming apparatus as shown in Figs. 6 and 7, however, the accessing directions for replacement of the process cartridges and

paper jamming recovery are on the apparatus front and side, so that there is a problem that a larger working space is necessary. It is disadvantageous that the apparatus side space is required during pulling out and inserting of the process cartridges. Furthermore, the apparatus tends to be larger and more complicated due to a moving mechanism of the intermediate transfer belt for releasing pressure between the intermediate transfer belt and the photosensitive drum of the process cartridge during replacement of the process cartridge, thereby increasing the cost of the apparatus.

[0008]

Because a sliding mechanism for pulling out and inserting the process cartridges is inevitably provided, the apparatus tends to be larger and more complicated. In the publication JP-A-11-133,694, when the operator conducts the maintenance work for the photosensitive bodies or the like while standing at a front side, the apparatus is structured as not to open the photosensitive belt unit upward unless the transfer unit is made open toward the front side about a pivot at the apparatus lower portion, and therefore, there arises problems such that not only the transfer portion opened toward the front side may become disturbed, but also the operator cannot easily access the developing unit or the like when two opening operations are needed. Moreover, other conventional designs relating to the opening and closing operation of the apparatuses are exemplified in Japanese Patent Application Publications JP-A-10-307,439 and JP-A-2002-6583.

## **Summary of the Invention**

[0009]

It is an object, in consideration for solving the above problems, to provide an image forming apparatus with improved controllability including jamming recovery and apparatus maintenance property and with a simplified structure.

[0010]

A preferable image forming apparatus according to the invention to accomplish the above object includes: an image carrier for carrying an image; an intermediate transfer body to which the image on the image carrier is transferred; transfer material conveying means for conveying a transfer material along a conveyance route; transfer means for transferring the image on the intermediate transfer body onto the transfer material conveyed by the transfer material conveying means; a delivery portion for delivering the transfer material on which the image is transferred; a first openable portion, openable with respect to an apparatus body, for holding the intermediate transfer body and the delivery portion; and a second openable portion openable to expose the conveyance route, wherein the first and second openable portions are opened and closed independently of each other.

## **Brief Description of the Drawings**

[0011]

Fig. 1 is a cross-section showing an image forming apparatus;

Fig. 2 is a cross-section showing a first openable portion in an opened state;

Fig. 3 is a cross-section showing a jamming recovery operation where a second openable portion is opened;

Fig. 4 is a cross-section showing a process cartridge replacement operation; Fig. 5 is a cross-section illustrating an image forming apparatus of another embodiment;

Fig. 6 is a perspective view showing a conventional image forming apparatus; and

Fig. 7 is a cross-section showing the conventional image forming apparatus.

### **Detailed Description of the Preferred Embodiments**

[0012]

Hereinafter, embodiments of the invention are described in referring to the drawings. First, based on Fig. 1, an image forming process is described. A printer serving as an image forming apparatus includes four photosensitive drums 20a (yellow), 20b (magenta), 20c (cyan), 20d (black) serving as image carriers disposed parallel for forming toner images in respective colors of yellow, magenta, cyan, and black, and an intermediate transfer belt 2 disposed above those photosensitive drums 20a to 20d in such a manner to downwardly contact those drums. The photosensitive drums and the intermediate transfer belt rotate in a direction of the arrows shown in Fig. 1.

[0013]

A charger 31, a developer 32, and a cleaner 33 are disposed around the photosensitive drum 20a, and are integrated as a process cartridge (image forming unit) 1a. The other photosensitive drums 20b to 20d also have substantially the same structure as the photosensitive drum 20a and form the process cartridges 1b to 1d, respectively. The photosensitive drums 20a to 20d are charged by the respective

chargers, and latent images for yellow, magenta, cyan, and black are formed on the photosensitive drums 20a to 20d upon exposure of color-resolved photo images in respective colors, yellow, magenta, cyan, and black, with an exposing apparatus 6. The respective latent images are developed with the developers to form toner images in yellow, magenta, cyan, and black on the photosensitive drums 20a to 20d, thereby being transferred onto the intermediate transfer belt 2 sequentially.

[0014]

A transfer material P is contained in a feeding cassette 4. The feeding cassette 4 has a structure that can be pulled out through a front side, and for example, supply of the transfer material P and recovery of paper jamming can be effected by pulling the feeding cassette 4 through the front side of the apparatus. Each sheet of transfer material P is fed out one by one by a pickup roller (feeding conveying means) 8 from the feeding cassette 4, and is conveyed to a nipping portion formed by a secondary transfer roller 3 and the intermediate transfer belt 2 after matching the timing by means of a register roller 9, to thereby secondarily transfer the toner image on the intermediate transfer belt 2.

[0015]

The transfer material P on which the toner images are secondarily transferred is then conveyed to a fixing unit 5, where fixing is effected by applying heat and pressure. Fixing melts the toners in respective colors and brings mixed colors to form a full color printed image immobilized on the transfer material P, and then, the transfer material P is delivered to a delivery tray 7 by a delivery conveying means 21 disposed on a downstream side of the fixing unit 5.

[0016]

Next, an apparatus structure is described. In the color image forming apparatus shown in Fig. 1, the feeding cassette 4 is disposed on the lowest portion of apparatus body 30. The process cartridges 1a to 1d for performing image formation are arranged sequentially below the intermediate transfer belt 2 at the apparatus body 30, and an exposing apparatus 6 is disposed below the process cartridges 1a to 1d.

[0017]

The delivery tray 7 is disposed above the intermediate transfer belt 2. The intermediate transfer belt 2 and the delivery tray 7 are integrated in a same housing (top opening mechanism, first openable portion) 12, and are openable around a shaft 100 as a center with respect to the apparatus body 30 as shown in Fig. 2. The fixing unit 5 is disposed above the secondary transfer roller 3 at a location not interfering with the housing 12 during opening and closing. A conveyance route 25 of the transfer material is arranged on a front side of the apparatus body, and defines a route from the feeding cassette 4 located at the lowest position to the delivery tray 7. A front door (front opening mechanism, second openable portion) 11 has a center 101 at a lower portion of the apparatus front side to allow accessing to the conveyance route 25, and is openable along the conveyance route 25, which serves as a boundary. At that time, the secondary transfer roller 3 is exposed while being supported by the front door 11.

[0018]

Manipulations during process cartridge replacement and paper jamming recovery are now described. Fig. 3 is a cross-section of the apparatus during a jamming recovery operation. In a case that jamming occurs during the operation of

the image forming apparatus, the pressure of a spring or the like pushing the secondary transfer roller 3 to the intermediate transfer belt 2 is released, and then, the front door 11 is opened about the shaft 101 as a center located at the lower portion as shown in Fig. 3. After the front door 11, which is movable forward and backward with respect to the conveyance route 25, is thus moved toward the front side of the apparatus body 30, paper jamming recovery is performed at the conveyance route 25.

[0019]

Fig. 4 is a cross-section of the apparatus during a process cartridge replacement operation. When the process cartridges 1a to 1d are to be replaced as maintenance work, an operator M upwardly opens the housing 12, which forms the delivery tray 7 and the transfer belt 2. For example, when the process cartridge 1d for black is to be replaced, after the process cartridge 1d is pulled out upwardly, a new one is attached. At that time, the front door 11, which can be opened for the jamming recovery, is not necessarily opened, so that the process cartridge 1 can be accessed easily. The process cartridge 1 can be inserted along a guide from an upper position when installing, so that no space is needed for forming a sliding mechanism for pulling out and inserting the process cartridge from a side surface of the apparatus body, and so that with a simpler structure, the apparatus can be made in a smaller size and the costs can be reduced.

[0020]

Other embodiments

Although in the above embodiment the housing 12 is opened and closed with respect to the conveyance route 25 as a boundary and about the shaft 100 as a center

to replace the process cartridges, the invention is not limited to this, and as shown in Fig. 5, the housing 12 can be structured to include not only the intermediate transfer belt 2 and the delivery tray 7, but also the fixing unit 5.

[0021]

Although in the above embodiments, the image forming apparatus is described as a printer, the invention is not limited to this, and can be incorporated in other apparatuses, such as a facsimile machine or a photocopier.